

NOTES ON THE METAMORPHOSIS OF THE BRASSOLIDAE (LEPIDOPTERA).

BY MARSTON BATES, Museum of Comparative Zoölogy,
Cambridge, Mass.

The literature on the metamorphosis of most tropical Lepidoptera is very scattered, and few summaries exist. For this reason it was thought that a review of what is known of the early stages of the Brassolidae might be of value in connection with a more detailed study of one of the species (*Opsiphanes cassina fabricii* Boisd.). No literature references are included that have not been seen, which means that one or two possibly important papers are omitted. I have to thank Mr. Carl Heinrich for lending me a specimen of the larva of *Brassolis isthmia* Bates; I have not seen larvae of *Eryphanis* or *Narope*; the material used in the other genera is in the collection of the Museum of Comparative Zoölogy.

The family Brassolidae has been reviewed several times in recent years, and general statements on the metamorphosis are included by Stichel (1904 and 1909) and Fruhstorfer (1912), although for the most part these simply restate the observations of Müller (1886). The larvae of six genera have been described: *Brassolis*, *Caligo*, *Dynastor*, *Eryphanis*, *Narope* and *Opsiphanes*. All of these except *Brassolis* are characterized by the development of spines or horns on the head, an indication for four pairs being present, although (as in *Opsiphanes cassina*) only two pairs may be developed. The body is characteristically thickened in the middle, tapering toward each end; the ground color is either brown or green, and the markings, as in the Satyridae, consist of longitudinal lines. Caudal horns (the "tail-fork") are developed in all genera except *Brassolis*.

The scale-like hairs of the head of the first stage larvae of *Opsiphanes* and *Dynastor* form one of the most interesting features found in the family. Figure 1 shows the form and distribution of these in the larva of *Opsiphanes cassina fabricii*. Müller (1886, p. 210) has discussed the significance of these modified hairs at some length, although he is unable to form any definite conclusion as to their meaning. They are apparently a specialization of the 1st stage larva, serving to accentuate the "poodle-like" appearance of the head. In Müller's species (*O. tamarindi* and *D. darius*) the modified hairs do not persist beyond the 1st

stage. In *O. cassina fabricii* we find them present in the 1st, 2nd, 3rd and 4th stages.

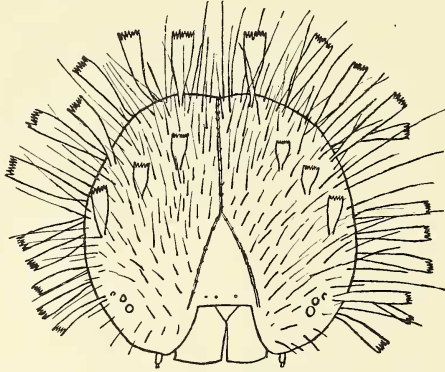


Fig. 1. *Opsiphanes cassina fabricii* Boisdl., head of first stage larva.

The larvae of the family Brassolidae can probably best be separated from other butterfly larvae by the arrangement of the crochets of the prolegs, and by the position in which the head is held. The crochets form an ellipse, interrupted only at the outer end, the long axis of which is transverse to the body of the caterpillar: a character that they seem to share with no other larvae of the Nymphalid (*s. l.*) group, although it is identical with the arrangement found in many Hesperidae. The head in this family is somewhat flattened, and held in a more or less horizontal position, so that the dorsal margin becomes caudal.

The larvae of the Nymphalid genus *Charaxes* are strikingly similar to those of many Brassolids, as they have both the cephalic horns and the tail-fork. Without material for comparison it is impossible to decide whether this resemblance is purely superficial. (For a summary of the larval characters of *Charaxes*, see Rothschild and Jordan, 1900, p. 282). The similarity in pattern to the Satyridae has already been remarked; the close relationship between this family and the Brassolids is also shown in the development of the tail-fork. I had thought that it might be possible to interpolate the Brassolidae and other tropical families in existing keys to the larvae of Lepidoptera; but such keys, based largely on that of Fracker (1915), become so unsatisfactory when tropical species are considered that it is better to await a more comprehensive tabulation. The Brassolidae trace to the Hesperidae in the key of Brues and Melander (1932); or, if the proleg

character be overlooked, to couplet 97 (p. 253), where they differ from further families in the possession of anal tubercles. Larvae of the genus *Brassolis* are difficult to separate from the Hesperidae on superficial characters.

The following is suggested as a tentative key to the larvae of Brassolidae, as far as known to me:

1. No horns on head *Brassolis*
Horns present 2.
2. Body with several, usually 4, mediodorsal spines *Caligo*
Spines not present, or represented only by short warts 3.
3. Warts developed on mediodorsal line *Eryphanis*
No such warts 4.
4. Two or more oval markings on mediodorsal line in place of
spines or warts *Dynastor*
No such markings *Opsiphane* (*Narope*?)

As I have pupae of only two genera (*Brassolis* and *Opsiphanes*), no general remarks can be made. The relationship, however, seems to be with the Satyridae, where they trace in Mosher's keys (1916).

Genus BRASSOLIS Fabr.

The larvae of several species of this genus are well known, as they feed gregariously on palms, to which they may cause considerable damage. Müller (1886) considered the absence of cephalic horns and the tail-fork in this genus to be a specialization, but to me his reasoning is not entirely convincing.

Brassolis sophorae sophorae Linn.

Cleare, 1915: life history in British Guiana; Rothschild, 1916, p. 314, pl. VI, f. 7, larva, f. 9, pupa.

Food-plant: Palms, including the coconut and *Oreodoxa regia*; at times a pest.

Brassolis sophorae vulpeculus Stich.

Rothschild, 1916, p. 314, larva. Food-plant not mentioned.

Brassolis astyra astyra Godt.

Müller, 1886, p. 179; Rothschild, 1916, p. 315, pl. VI, f. 8, larva.

Food-plant: "palms."

Brassolis isthmia Bates.

Schultz, 1908; Dunn, 1917; Zetek, 1919.

Food-plant: Palms, including *Martinezia caryotaefolia*, *Oreodoxa regia*, *O. oleracea*, *Thrinax spp.* and the coconut; at times very destructive. Zetek reports it also from banana.

Genus DYNASTOR Westwood.

Dynastor darius darius Fabr.

Müller, 1886, p. 172; Rothschild, 1916, p. 310, pl. VI, f. 13, larva, f. 11, pupa. A larva in the MCZ from Rio de Janeiro seems to be this species.

Food-plants: Pineapple and other Bromeliaceae.

Dynastor napoleon Westwood.

Rothschild, 1916, p. 309, pl. III, f. 5, larva, f. 6, pupa.

Food-plant: Bromeliaceae.

Genus NAROPE Westwood.

Narope cyllaistros Dbl. Hew.

Füller, 1886, p. 178.

Food-plant: *Bambusa*.

Genus OPSIPHANES Westwood.

Opsiphanes batea batea Hbn.

Rothschild, 1916, p. 310, pl. V, f. 8, larva, f. 6, pupa.

Food-plant: "a species of palm."

Opsiphanes cassiae cassiae Linn.

Guppy, in Kaye, 1904, p. 226, pl. XVII, ff. 2-2b, 2nd stage, 3rd stage and full grown larva. Food-plant not mentioned.

Opsiphanes cassiae lucullus Fruhst.

Rothschild, 1916, p. 311, pl. V, f. 7, larva, f. 8, pupa.

Food-plant: "Banana."

Opsiphanes tamarindi Felder.

Müller, 1886, p. 170.

Food-plant: "*Musa*" (Banana).*Opsiphanes bogotanus bogotanus* Dist.

Rothschild, 1916, p. 311, pl. VI, f. 5, larva, f. 6, pupa.

Food-plant: "Banana."

Opsiphanes invirae amplificatus Stich.

Hayward, 1929. Food-plant not mentioned.

Opsiphanes invirae remoliatus Fruhst.

Rothschild, 1916, p. 311, pl. VI, f. 10, larva, f. 12, pupa.

Food-plant: "Giriva and palms."

Opsiphanes cassina fabricii Boisd.

The following observations on the life history of this species were made at Tela, Honduras, in 1929.

Egg. The butterfly was observed ovipositing about 3 o'clock on a cloudy afternoon. The eggs were laid singly on the under-side of the leaves of a palm, *Guillielma utilis* Oerst.

The egg is spheroid, flattened at the base and somewhat less so at the top; 2 mm. in diameter, and of a pale green color. There are 31 rather prominent vertical ribs, which sometimes converge before reaching the top of the egg; these ribs are all connected by fine horizontal lines, thus forming rectangular cells. About the micropyle they abruptly degenerate into an irregular network of fine lines, the space thus formed being small and not noticeable without a lens.

Two days after oviposition, three definite dark brown rings have developed around the egg, although the general color has not changed perceptibly. Nine days after oviposition the egg has assumed a distinctly mottled appearance, irregularly blackish on one side, and with wavy lines, probably following the curve of the larval body, on the other. The egg stage lasts ten days.

Stage I. Width of head, 1.4 mm.; length of body, exclusive of anal horns, 6 mm.; anal horns 1.5 mm. long, with fine setae about 1 mm. longer.

The head is very large in proportion to the body, dark brown, rather shallowly sculptured. The cephalic horns are not as developed as in Müller's figures (*l. c.*, pl. II, f. 30a) for *O. tamarindi*, and would scarcely be distinguishable from the other sculpturing were one not looking for them. The whole head is covered with long, fine, grayish hairs, making what Müller calls the "poodle" type of head. Scattered among these hairs are a few that are curiously modified: shorter than the others, they are flattened, and fringed at the distal end, so as to look much like the scales of the adult wing. Our sketch (Fig. 1), made from the cast head capsule, shows the form and distribution of these.

The body is slender and straight, striped with yellow and red: yellow dorsally, with a fine, dark, medio-dorsal line; a rather broad reddish band subdorsally; below this two more reddish lines, with the rest of the body yellow. The last abdominal segment has two long, dark horns, terminating in fine setae: the so-called tail fork.

Three days after hatching, the reddish bands have become a clear yellow, leaving only a fine reddish line on the lower edge of each. This stage lasts 9 days.

Stage II. Width of head, 1.8 mm.; total length, including anal horns, 12 mm.; length of anal horns, 2.7 mm.

The head is still larger than the body, but not as much proportionally as in stage I. It is greatly changed in shape and position,

no longer round, but rather oblong, and held horizontally, so that the dorsal margin becomes caudal. This caudal margin bears a larger, inner pair of horns, a smaller outer pair, and a still smaller, slightly developed pair outside of these. The head is still covered with fine hairs, which show some concentration into a tuft between the ocelli and the mouth. The scale-hairs are still present; Müller states that they have disappeared at this stage in *O. tamarindi*. The head is in general dark, lightening to brown on the sides and around the frontal triangle. The epicranial suture is curiously flanked, just above the front, by two cream-colored dashes which, though small, appear very conspicuous against the dark head.

The body is much as in Stage I: a yellowish green medio-dorsal band, flanked by darker green subdorsal bands, which are in turn bordered ventrally by fine dark lines that run onto the anal horns, and two lighter lateral bands with dark central lines. The body is covered sparingly with fine secondary setae. The underside and prolegs are green.

Stage III. Width of head, 2.4 mm., now not much wider than body, longer in proportion to its width than before, horns proportionally smaller.

The epicranial suture is now enclosed in a light yellow band, which is in line with and similar to the dorsal band of the body. The frontal triangle is entirely included in this yellow. The mouth-parts are a dirty white, as are the sides of the head. The caudal margin of the head and central pair of horns are a very dark brown; the outer horns are more or less colorless. The head is still clothed with hairs as before, widely scattered except between the ocelli and mouthparts; the scale-hairs still persist.

Body much as in stage II, except that the caudal horns have acquired a distinct lavender tint.

Stage IV. Width of head, 3.4 mm. No notes were taken on this stage.

Stage V. Width of head, 4.4 mm.; total length, including anal horns, 47 mm.; length of anal horns, 4 mm.

The head, along the median suture, is yellow; the front is purplish on the sides, with a bright lavender line running to the base of each of the inner pair of horns. The sides, below the outer horns, are whitish; the ocelli are black, the mouthparts whitish, tipped with black. The inner pair of horns is orange, tipped with

black, the outer pair whitish. The head is covered with fine hairs, which become longer and more prominent over the ocelli. In this stage, for the first time, the scale-like hairs have disappeared.

The dorsal stripe of the body consists of four fine red lines, inclosing a light greenish area on the medio-dorsal line and white areas on either side. Subdorsally, the body is greenish, granulated with white. The subdorsal band consists again of two fine red lines enclosing a whitish one; the suprspiracular band is the same, the inclosed area being greenish. The spiracles are very small, reddish-brown spots, not distinguishable with the unaided eye. The legs are small, reddish. The caudal horns are reddish brown, heavily granulated with white, and covered with fine white setae; the tips are black.

Stage VI. Width of head, 5.5 mm.; total length (from another specimen), 50 mm.; anal horns, 9 mm. long.

The whole animal has become overcast with gray; the head, along the epicranial suture, is a greenish gray rather than yellow; the outer pair of horns have become concolorous with the stripe that runs to their base, and are tipped more heavily with black. The inner pair of the dorsal red lines of the body has become dark and the outer pair light, red; the other red lines have all become darker, and are not sharply differentiated from the ground-color of the body.

Pupa. The transverse ridge of the head has distinct and rather prominent cephalo-lateral angles, projecting about 1 mm. forward. This cephalic ridge is continued laterally to the second abdominal segment, where it ends, with a small iridescent spot ventral to it. The metathorax is elevated, with a median ridge, distinct but not prominent, which extends caudad to the cremaster and continues forward to the cephalic ridge as a line.

The circular ridge surrounding the anal opening is fairly prominent, composed of tubercles which are largest on either side of the genital opening. The cremaster also has two lateral rows of tubercles. The setae of the cremaster form a ring, with a depression in the center.

Genus ERYPHANIS Boisd.

Eryphanis reevesii reevesii Westw.

Müller, 1886, p. 175, as *Caligo riviesii*.

Food-plant: *Olyra latifolia*; *Bambusa*.

Genus CALIGO Hübner

- Caligo illioneus illioneus* Cramer
Cleare, 1926, description and figures.
Food-plant: "Banana."
- Caligo illioneus pampeiro* Fruhst.
Rothschild, 1916, p. 312, pl. V, f. 1, larva.
Food-plant: "Banana."
- Caligo illioneus saltus* Kaye
Guppy, in Kaye, 1904, p. 226, pl. XVII, f. 1-1f. (egg and all stages except 4th.)
Food-plant: "Banana."
- Caligo prometheus epimetheus* Feld.
Rothschild, 1916, p. 313, pl. V, f. 2, larva.
Food-plant; "Banana."
- Caligo brasiliensis brasiliensis* Feld.
Müller, 1886, p. 174, as *Caligo eurylochus*; Silva, 1907, p. 91, as *Caligo eurylochus*; Rothschild, 1916, p. 313, pl. V, f. 9, larva, f. 10, pupa.
Food-plant: Musaceae (Banana); *Hedychium*.
- Caligo memnon memnon* Feld.
Davis, 1915, description and figures of life history in British Honduras.
- Caligo oberthuri oberthuri* Deyr.
Rothschild, 1916, p. 314, pl. V, f. 3, larva.
Food-plant: "a palm."
- Caligo beltrao* Ill.
Müller, 1886, p. 175.
"Food-plant as *C. eurylochus*." (Musaceae, *Hedychium*).

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